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STEPTOE & JOHNSON LLP
1330 CONNECTICUT AVENUE, N.W.
WASHINGTON, DC 20036

EXAMINER	
CARLSON, KAREN C	
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte CHARLOTTE HORSMANS POULSEN and
KARSTEN MATTHIAS KRAGH

Appeal 2009-005132
Application 09/998,284
Technology Center 1600

Decided: December 1, 2009

Before LORA M. GREEN, RICHARD M. LEBOVITZ, and
JEFFREY N. FREDMAN, *Administrative Patent Judges*.

FREDMAN, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 involving claims to an anti-fouling composition and method of use. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

Statement of the Case

The Claims

Claims 1-3, 9-15, 34, 35, and 40-50 are on appeal. We will focus on claim 1, which is representative and reads as follows:

> 1. An anti-fouling composition comprising
> (i) a surface coating material;
> (ii) a first enzyme and a first substrate, wherein the first substrate is an oligomer or a polymer of a second substrate, said second substrate being a substrate for an oxidative enzyme, and wherein first enzyme is capable of generating said second substrate from said first substrate; and
> (iii) a second enzyme, wherein the second enzyme is an oxidase; and wherein said second enzyme generates an anti-fouling compound when acting on said second substrate.

The prior art

The Examiner relies on the following prior art references to show unpatentability:

Hamade (hereinafter Hamade '188) US 5,770,188 Jun. 23, 1998

Hamade (hereinafter Hamade (EP)) EP 0866103 A1 Sep. 23, 1998

Hansen, *Hexose Oxidase from the Red Alga Chondrus crispus*, 272(17) J. BIOLOGICAL CHEMISTRY 11581-11587 (1997).

James, *Glucoamylases: Microbial Sources, Industrial Applications and Molecular Biology – A Review*, 21 J. FOOD BIOCHEMISTRY 1-52 (1997).

The issues

A. The Examiner rejected claims 1, 11-14, 34, 35, 40, 41, 42, 44, 45, 48, 49, and 50 under 35 U.S.C. § 103(a) as obvious over Hamade (EP) (Ans. 4-6).

B. The Examiner rejected claims 2, 3, 40, 43, 44, and 47 under 35 U.S.C. § 103(a) as obvious over Hamade (EP) and Hansen (Ans. 6-7).

C. The Examiner rejected claims 9, 10, 14, 45, and 46 under 35 U.S.C. § 103(a) as obvious over Hamade (EP) and James (Ans. 7-8).

D. The Examiner rejected claim 15 under 35 U.S.C. § 103(a) as obvious over Hamade (EP), James, and Hamade ('188) (Ans. 8-9).

A. 35 U.S.C. § 103(a) over Hamade (EP)

The Examiner rejected claims 1, 11-14, 34, 35, 40, 41, 42, 44, 45, 48, 49, and 50 under 35 U.S.C. § 103(a) as obvious over Hamade (EP) (Ans. 4-6).

The Examiner finds that Hamade (EP) "teach that the compound having antimicrobial activity may be a compound obtained as the direct result of enzymatic reaction between the enzyme and the substrate OR *the compound having antimicrobial activity may be a compound formed from the product of such enzymatic reaction through further enzymatic reaction*" (Ans. 4). The Examiner finds it obvious to make an antifouling composition

> comprising a surface coating material . . . a first enzyme and first substrate to make a product (second substrate) which undergoes further enzymatic reaction to form the antimicrobial/antifouling compound, wherein the further enzymatic reaction is derived from an oxidase (second enzyme) to make hydrogen peroxide . . . because Hamade et al. teach that a compound having antimicrobial/anti-fouling activity may be a compound formed from the product of a

> first enzymatic reaction through a further second enzymatic reaction

(Ans. 5-6).

Appellants argue that "[t]here is no suggestion or motivation in Hamade to modify the teachings of Hamade to produce an anti-fouling composition that includes a surface coating material, a first enzyme, a first substrate and a second enzyme" (App. Br. 7).

Appellants argue that "Hamade does not teach or suggest any other enzyme or substrate in a coating composition. Hamade also does not provide a reasonable expectation of successfully including a second enzyme in a composition or in a surface coating or coating material" (App. Br. 5). Appellants argue that "the disclosure in Hamade would actually lead the skilled person away from the subject matter at claims 1, 49 and 50 because Hamade teaches that a composition with only one enzyme has an anti-fouling effect. See Example 4 of Hamade" (App. Br. 5).

In view of these conflicting positions, we frame the obviousness issue before us as follows:

Have Appellants demonstrated that the Examiner erred in finding it obvious over Hamade to form the anti-fouling composition of claim 1?

Findings of Fact (FF)

1. Hamade (EP) teaches that "[c]ompounds having antimicrobial activity, inclusive of antifouling agents . . . are in broad use today" (Hamade (EP) 2, ll. 10-11).

2. Hamade (EP) teaches "a method for releasing a compound having antimicrobial activity from a matrix at a controlled rate, which

comprises incorporating an enzyme and a substrate in said matrix beforehand to allow said enzyme and said substrate to react with each other in said matrix to thereby produce said compound having antimicrobial activity" (Hamade (EP) 3, ll. 13-16).

3. Hamade (EP) teaches a "coating composition comprising a film-forming resin, an enzyme, and a substrate, said enzyme being capable of reacting with said substrate to produce a compound having antimicrobial activity" (Hamade (EP) 3, ll. 17-19).

4. Hamade (EP) teaches that "[i]t should be understood that said compound having antimicrobial activity may be a compound obtained as the direct result of enzymatic reaction between the enzyme and the substrate or a compound formed from the product of such enzymatic reaction through further enzymatic or chemical reaction" (Hamade (EP) 3, ll. 39-41).

5. Hamade (EP) teaches that "[t]ypical of the latter case in which the compound heaving [sic, having] antimicrobial activity is formed from such an enzymatic reaction product through further enzymatic or chemical reaction is the case in which such an enzymatic reaction product is a precursor of the objective compound having antimicrobial activity" (Hamade (EP) 3, ll. 43-46).

6. Hamade (EP) teaches that an "enzyme-substrate combination capable of producing hydrogen peroxide is not particularly restricted but preferably includes a combination such that the enzyme is an oxidase and the substrate is a compound to be oxidized by said oxidase" (Hamade (EP) 5, ll. 14-16).

7. Hamade (EP) teaches that a "combination of said oxidase with said compound to be oxidized thereby is not particularly restricted but specifically includes such combinations as . . . hexose oxidase-glucose" (Hamade (EP) 5, ll. 17-18).

8. Hamade (EP) teaches the enzyme reaction which is shown below:

1) Compound A (substrate) + oxygen →

Compound B (oxide of Compound A) + hydrogen peroxide

Hamade (EP) teaches that the "enzymatic reaction between said oxidase and its substrate compound yields hydrogen peroxide" (Hamade (EP) 5, ll. 23-30).

9. The Examiner finds that the teachings of Hamade (EP) regarding the enzyme reaction can be summarized as shown below:

Enzyme1 + Substrate1→ Glucose (Substrate2) + Hexose Oxidase (Enzyme2)→ Hydrogen Peroxide (Anti-fouling compound)

(Ans. 5).

10. Hamade (EP) teaches, in claim 14, a "coating composition comprising a film-forming resin, an enzyme, and a substrate, said enzyme being capable of reacting with said substrate to produce a compound having antimicrobial activity" and further teaches in claim 19 the "coating composition according to claim 14 . . . wherein said enzyme is an oxidase and said substrate is a compound to be oxidized by said oxidase" (Hamade (EP) 9, ll. 40-56).

11. Hamade (EP) teaches enzymes where

> The esterase is not particularly restricted in kind but includes esterases such as carboxylesterase, arylesterase, acetylesterase, etc.; lipases such as triacylglycerol lipase, lipoprotein lipase, etc.; and proteases such as subtilisin, chymotrypsin, tripsin [sic], elastase, cathepsin, papain, chymopapain, pepsin, etc., and so forth . . .
>
> The amidase mentioned above is not particularly restricted in kind but includes proteases such as chymotrypsin, trypsin, acrocin, elastase, subtilisin, cathepsin, proteinase, papain, physin, chymopapain, pepsin, chymosin, and so forth. . . .
>
> An enzyme-substrate combination capable of producing said aldehyde group-containing compound is not particularly restricted but includes the case in which the enzyme is alcohol dehydrogenase and the substrate is an aliphatic alcohol, e.g. methanol, ethanol, etc.; the case in which the enzyme is alcohol oxidase and the substrate is an aliphatic alcohol such as methanol, ethanol, etc.; the case in which the enzyme is arylalcohol dehydrogenase and the substrate is an aromatic alcohol such as phenol, cresol, etc.; and the case in which the enzyme is amine oxidase and the substrate is an aliphatic amine such as butylamine, hexylamine, and so forth.
>
> An enzyme-substrate combination capable of producing hydrogen peroxide is not particularly restricted but preferably includes a combination such that the enzyme is an oxidase and the substrate is a compound to be oxidized by said oxidase.

(Hamade (EP) 4, l. 6 to 5, l. 16).

Principles of Law

The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) secondary considerations of nonobviousness, if any. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

The Supreme Court has recently emphasized that "the [obviousness] analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR Int'l v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).

"The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *Id.* at 416. "If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability." *Id.* at 417.

As noted by the Court in *KSR*, "[a] person of ordinary skill is also a person of ordinary creativity, not an automaton." *Id.* at 421.

Analysis

Hamade (EP) teaches an antifouling composition which comprises an surface coating material, an oxidase and a substrate for the oxidase (FF 1-3, 6-8, 10). Hamade (EP) further teaches that "[i]t should be understood that said compound having antimicrobial activity may be a compound obtained as the direct result of enzymatic reaction between the enzyme and the substrate or a compound formed from the product of such enzymatic reaction through further enzymatic or chemical reaction" (Hamade (EP) 3, ll. 39-41; FF 4).

Hamade (EP) therefore expressly suggests that the composition may encompass multiple enzymatic steps, with a first enzymatic step that forms a substrate which is then used in a second enzymatic step that forms the compound with antimicrobial activity which serves as the "anti-fouling

compound" as in claim 1 (FF 4, 5, 9). Hamade (EP) explains this formation of an enzyme precursor in noting that "[t]ypical of the latter case in which the compound heaving [sic] antimicrobial activity is formed from such an enzymatic reaction product through further enzymatic or chemical reaction is the case in which such an enzymatic reaction is a precursor of the objective compound having antimicrobial activity" (Hamade (EP) 3, ll. 43-46; FF 5).

We agree with the Examiner that in these disclosures Hamade (EP) directly suggests using a "first enzyme and first substrate to make a product (second substrate) which undergoes further enzymatic reaction to form the antimicrobial/antifouling compound" (Ans. 5-6).

We are not persuaded by Appellants' argument that "Hamade does not teach or suggest any other enzyme or substrate in a coating composition" (App. Br. 5). We understand Appellants to be arguing that Hamade does not teach the use of a precursor enzyme to form the initial substrate. While Hamade (EP) does not exemplify this combination, Hamade (EP) does expressly teach that the antimicrobial compound may be "formed from such an enzymatic reaction product through further enzymatic or chemical reaction is the case in which such an enzymatic reaction is a precursor of the objective compound having antimicrobial activity" (Hamade (EP) 3, ll. 43-46; FF 5). This teaching of a precursor enzymatic reaction to form the actual substrate that is used to form the antimicrobial compound is a direct suggestion by Hamade (EP) suggesting the use of a two-enzyme system as in claim 1(FF 4-5).

We are not persuaded by Appellants' argument that "Hamade also does not provide a reasonable expectation of successfully including a second enzyme in a composition or in a surface coating or coating material" (App. Br. 5). Hamade (EP) teaches that the first enzyme will function in a surface coating or coating material composition (FF 1-3), and Hamade (EP) teaches a variety of different enzymes which will function (FF 11). Appellants have provided no evidence which would suggest that the precursor enzymes suggested by Hamade (EP) would not have been reasonably expected to function in the coating composition. *Kubin* stated that "[r]esponding to concerns about uncertainty in the prior art influencing the purported success of the claimed combination, this court [in *O'Farrell*] stated: '[o]bviousness does not require absolute predictability of success … *all that is required is a reasonable expectation of success*.'" *In re Kubin*, 561 F.3d 1351, 1360 (Fed. Cir. 2009) (*citing In re O'Farrell*, 853 F.2d 894, 903-904 (Fed. Cir. 1988)). We conclude that given the direct suggestion in the prior art of Hamade (EP) that enzymes would be effective in the coating compositions (FF 11), there would have been a reasonable expectation of success in following the suggestion of Hamade (EP) to include functional precursor enzymes in the coating composition (FF 4-5).

We are not persuaded by Appellants' argument that "the disclosure in Hamade would actually lead the skilled person away from the subject matter at claims 1, 49 and 50 because Hamade teaches that a composition with only one enzyme has an anti-fouling effect" (App. Br. 5). Hamade (EP) clearly suggests the use of multiple enzyme systems (FF 4-5). Further, Appellants do not identify any specific teaching in Hamade (EP) which teaches away

from the use of a multiple enzymes. Like our appellate reviewing court, "[w]e will not read into a reference a teaching away from a process where no such language exists." *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1364 (Fed. Cir. 2006).

We also do not find persuasive Appellants' argument that the "Examiner's argument that this passage teaches the use of a composition that includes more than one enzyme is inconsistent with the disclosure throughout the rest of the Hamade document which, despite disclosing a large number of different enzymes, only ever discloses one single enzyme in any of the compositions that Hamade describes" (Reply Br. 5). Simply because the teaching by Hamade (EP) of using additional enzymes is not a central element of the disclosure does not negate the suggestion that a "compound having antimicrobial activity may be a compound obtained as the direct result of enzymatic reaction between the enzyme and the substrate or a compound formed from the product of such enzymatic reaction through further enzymatic or chemical reaction" (Hamade (EP) 3, ll. 39-41; FF 4). Once Hamade (EP) suggested further enzymatic reaction, the ordinary artisan of ordinary creativity would have reasonably selected enzyme pathways from Hamade which would permit such further enzymatic reaction. "A person of ordinary skill is also a person of ordinary creativity, not an automaton." *KSR*, 550 U.S. at 421.

Conclusion of Law

Appellants have not demonstrated that the Examiner erred in finding it obvious over Hamade to form the anti-fouling composition of claim 1.

B. 35 U.S.C. § 103(a) over Hamade (EP) and Hansen

The Examiner rejected claims 2, 3, 40, 43, 44, and 47 under 35 U.S.C. § 103(a) as obvious over Hamade (EP) and Hansen (Ans. 6-7).

The Examiner finds it obvious to combine the "hexose oxidase . . . taught by Hansen et al. in the composition comprising hexose oxidase taught by Hamade et al. because Hamade et al. teach to use the combination of hexose oxidase and glucose for the production of the antimicrobial/anti-fouling compound hydrogen peroxide and the hexose oxidase of Hansen et al. is a useful art-recognized equivalent in the catalytic conversion of glucose to hydrogen peroxide" (Ans. 7).

The Examiner provides sound fact-based reasoning for combining Hamade (EP) with Hansen. As Appellants essentially reiterate the arguments made with respect to claim 1 (App. Br. 7-8), we affirm the rejection of claims 2, 3, 40, 43, 44, and 47 for the reasons stated by the Examiner.

C. 35 U.S.C. § 103(a) over Hamade (EP) and James

The Examiner rejected claims 9, 10, 14, 45, and 46 under 35 U.S.C. § 103(a) as obvious over Hamade (EP) and James (Ans. 7-8).

The Examiner finds it obvious to

> include amyloglucosidase . . . in the composition of Hamade et al. because Hamade et al. teach that the compound having antimicrobial/anti-fouling activity may be formed from the product of such enzymatic reaction through further enzymatic reaction of hexose oxidase and glucose, and James et al. teach that an enzymatic reaction producing glucose is the catalysis of starch by amyloglucosidase.

(Ans. 8).

Appellants "submit that a person of skill in the art would not look to the James references as James relates to the food industry. James does not teach or suggest an anti-fouling composition that includes a surface coating material, a first enzyme, a first substrate and a second enzyme" (App. Br. 8).

In view of these conflicting positions, we frame the obviousness issue before us as follows:

Have Appellants demonstrated that the Examiner erred in finding it obvious to use the amyloglucosidase of James in the anti-fouling composition of Hamade (EP)?

Findings of Fact

12. Hamade (EP) teaches, among others, the enzyme-substrate combinations of "glucose oxidase-glucose; hexose oxidase-glucose" where the substrate glucose is then converted to hydrogen peroxide (Hamade (EP) 5, ll. 18-40).

13. James teaches that "[g]lucoamylase is an exo-acting enzyme which breaks down starch into its component unit, β-D-glucose. Glucoamylase has been loosely called amyloglucosidase" (James 2).

Principles of Law

In *Icon*, the Federal Circuit explained that:

> A reference is reasonably pertinent if, even though it may be in a different field from that of the inventor's endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to an inventor's attention in considering his problem. *In re Clay*, 966 F.2d

> 656, 659 (Fed.Cir.1992). In other words, "familiar items may have obvious uses beyond their primary purposes." *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 127 S.Ct. 1727, 1742 (2007). We therefore have concluded, for example, that an inventor considering a hinge and latch mechanism for portable computers would naturally look to references employing other "housings, hinges, latches, springs, etc.," which in that case came from areas such as "a desktop telephone directory, a piano lid, a kitchen cabinet, a washing machine cabinet, a wooden furniture cabinet, or a two-part housing for storing audio cassettes." *Paulsen*, 30 F.3d at 1481-82.

In re ICON Health and Fitness, Inc., 496 F.3d 1374, 1379-1380 (Fed. Cir. 2007).

Analysis

We are not persuaded by Appellants' argument that "a person of skill in the art would not look to the James references as James relates to the food industry" (App. Br. 8). In fact, as in *Icon*, an ordinary practitioner interested in enzyme pathways for use in antifouling compositions, as suggested by Hamade (EP), would have looked at known enzyme pathways. One enzyme-substrate pair suggested by Hamade (EP) was hexose oxidase-glucose (FF 12). Since Hamade (EP) suggests the use of "an enzymatic reaction product [which] is a precursor of the objective compound having antimicrobial activity" (Hamade (EP) 3, ll. 43-46; FF 5), and the amyloglucosidase-starch pair produces glucose where starch is the precursor to forming glucose, we agree with the Examiner that the combination was obvious over the disclosures of Hamade (EP) and James.

Conclusion of Law

Appellants have not demonstrated that the Examiner erred in finding it obvious to use the amyloglucosidase of James in the anti-fouling composition of Hamade (EP).

D. 35 U.S.C. § 103(a) over Hamade (EP), James, and Hamade ('188)

The Examiner rejected claim 15 under 35 U.S.C. § 103(a) as obvious over Hamade (EP), James, and Hamade ('188) (Ans. 8-9).

The Examiner finds it obvious to "encapsulate the amyloglucosidase in lipid in the anti-fouling composition rendered obvious by the teachings of Hamade et al. (EP O 866103 A1) and James et al. because Hamade et al. (USP 5,770,188) teach that the combination of encapsulated glucoamylase (amyloglucosidase) and starch render anti-fouling paint compositions self-polishing (Claim 15)" (Ans. 9).

The Examiner provides sound fact-based reasoning for combining Hamade (EP) with James and Hamade '188. As Appellants essentially reiterate the arguments made with respect to claim 1 do not identify any material defect in the Examiner's reasoning (App. Br. 8-9), we affirm the rejection of claim 15 for the reasons stated by the Examiner.

SUMMARY

In summary, we affirm the rejection of claims 1 under 35 U.S.C. § 103(a) as being obvious over Hamade (EP). Pursuant to 37 C.F.R. § 41.37(c)(1)(vii)(2006), we also affirm the rejection of claims 11-14, 34, 35, 40, 41, 42, 44, 45, 48, 49, and 50 as these claims were not argued separately.

We affirm the rejection of claims 2, 3, 40, 43, 44, and 47 under 35 U.S.C. § 103(a) as obvious over Hamade (EP) and Hansen. These claims were not argued separately. 37 C.F.R. § 41.37(c)(1)(vii)(2006).

We affirm the rejection of claims 9, 10, 14, 45, and 46 under 35 U.S.C. § 103(a) as obvious over Hamade (EP) and James.

We affirm the rejection of claim 15 under 35 U.S.C. § 103(a) as obvious over Hamade (EP), James, and Hamade '188. This claim was not argued separately. 37 C.F.R. § 41.37(c)(1)(vii)(2006).

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv)(2006).

AFFIRMED

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STEPTOE & JOHNSON LLP
1330 CONNECTICUT AVENUE, N.W.
WASHINGTON DC 20036